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CARCASS QUALITY AND BLOOD METABOLITES OF BROILER CHICKENS FED SUPER SOSAT MILLET IN SUNFLOWER MEAL BASED DIETS

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Abstract

An experiment was conducted to evaluate the carcass quality and blood metabolites of broiler chickens fed Super SOSAT (SSM) pearl millet in sunflower meal based diets. Three hundred broiler chicks were randomly allotted to five dietary treatments in replicates of three containing 20 birds each in a completely randomized design. In the trial, Super SOSAT millet replaced maize at 0, 25, 50, 75 and 100% levels. Feed and water were served ad lib and the experiment lasted for 42 days. Results showed that all carcass indices measured were significantly (P<0.05) affected by the dietary treatments. However, only few organs showed influence of super SOSAT millet. Live weight of birds fed super SOSAT millet based diets (1.53 – 1.65 kg) were higher and similar among millet fed groups compared to the control (1.24 kg). The same trend was followed in plucked and eviscerated weights. However, carcass weight was highest (P<0.05) for birds on diet 5 (1.08kg) though did not differ from those on diets 2 (0.92 kg) and 3 (0.94 kg), followed by diet 4 (0.89 kg) and 1 (0.72 kg). In the same way, broiler chickens fed diet 5 (66.00 %) had higher dressing percent (P<0.05) than those on other diets which were the same (56.83 – 59.42 %). Organs weight as percentage of live weight showed significant influence of diets on heart weight with birds on diet 5 (0.61 %) having higher (P<0.05) weight which did not differ from that of birds on diets 1 (0.46 %) and 3 (0.52 %). Each of diets 2 and 4 had a lower value of 0.38 % which was comparable to diets 1 and 3. The weights of kidney (0.17 – 0.29 %), abdominal fat (1.86 – 2.02%) and liver (1.85 – 2.07 %) were not influenced by the replacement of maize with super SOSAT millet. Results for blood analysis showed that except for red blood cells (RBC), Mean corpuscular volume (MCV) and hydrocarbonate, no blood parameter was significantly (P>0.05) affected by the diets. The RBC count of birds on diets 5 (1.40 x 10^6/µl) and 4 (1.43 x 10^6/µl) which did not differ from those on diets 3 (1.23x 10^6/µl) and 1 (1.30 x 10^6/µl), were significantly (P<0.05) higher than that of birds fed diet 2 (1.00 x 10^6/µl) which was also comparable to diets 1 and 2. Conversely, packed cell volume (24.33 – 29.00 %), white blood cells (3.67 – 4.80x 10^3/µl), haemoglobin (5.77 – 7.33 g/dl) and cholesterol (4.50 – 6.50 mmol / l) did not differ among the diets. However, all blood parameters were within the normal reference range indicating that the birds were neither anaemic nor undernourished. It is therefore concluded that super SOSAT millet can replace up to 100% of dietary maize in sunflower meal based broiler chickens diets without significant metabolic disruptions. Based on the higher dressing percent of 66.00% for broiler chickens in diet 5 compared to the others, this diet is recommended for broiler chickens.

Keywords; Broiler Chickens, Blood Profile, Carcass quality, Sunflower meal, Super Sosat millet.

1.0 Introduction

All stakeholders in the livestock industry including policy makers have come to realize that the only reliable option in filling the generally known protein deficiency gap in the average Nigerian diet is to develop the livestock subsector (Tamburawa *et al.,* 2012; Adedeji *et al.,* 2014 and Olam, 2018). Among livestock enterprises, broiler production is one of the best immediate sources of animal protein supply. Bender and Smith (1997) have indicated that it takes 7 and 6 kg of grains to produce 1.0 kg of beef and pork respectively, while only 2.7 kg of grains is required to produce 1.0 kg poultry meat. Another added advantage is the short-term nature of broiler production business (42-49 days) (Sanni and Ogundipe, 2005; Heise *et al.,* 2015). However, poultry production is faced with constraints such as poor growth rate and competition between man and livestock for feed ingredients especially grains which had led to high cost of production. Cereal grains, especially maize which form the bulk of energy in poultry feeds are in short supply as a result of industrial and human needs (Nworgu *et al.,* 1999). It is therefore, necessary to search for suitable substitute for maize in a developing country such as Nigeria (Elangovan *et al.,* 2004).

Millet is the most widely grown cereal crop that has been successful cultivated in the semi-arid region of Africa and its cost is relatively less in the areas of cultivation. It has little industrial uses in Nigeria (Nyannor *et al.,* 2007). As a feedstuff, it is mainly grown to produce silage, hay (FAO, 2002). Studies have indicated that millet grain could potentially be successfully incorporated into poultry diets (Andrews and Kumar, 1992; Tonekar *et al.,* 2009; Yunusa *et al.,* 2015; Qaisrani *et al.,* 2018*)*. The protein content of millet, although variable, is higher than maize (Burton *et al.,* 1972; Sullivan *et al.,* 1990; Adeola *et al*., 1994; Batal and Dale, 2011; Cisse *et al.,* 2017 and Yilkal *et al.,* 2018)) and the amino acid profile is more balanced than maize (Sullivan *et al.,* 1990; Adeola *et al*., 1994; Amato and Forrester, 1995 and Yilkal *et al.,* 2018). However, it has a lower metabolizable energy content of 2555 kcal/kg than maize (Olomu, 1995). The same source has also indicated that millet has higher percent crude fibre (4.30 %), and ash (3.00 %) than maize. This study was therefore designed to study the carcass quality and blood metabolites of broiler chickens fed Super Sosat millet as a replacement for maize in Sunflower meal based diets.

2.0 Materials and Methods

2.1 Experimental site

The experiments were conducted at the Poultry Unit, Teaching and Research Farm, Abubakar Tafawa Balewa University, Bauchi. The town, Bauchi, is located within the southern guinea savannah on latitude 10.31 N and longitude 9.84 E. Furthermore, it is 616 metres above sea level characterized by two well-defined seasons; Rainy season (May-October) and dry season (November-April). The average annual rainfall is 1009mm, highest relative humidity 94 % (August) and the lowest 35 % (February). Temperatures are between 13 – 17^{o}C (December – February) and 36 – 37^{o} C (March – April) (World Atlas, 2015). According to ICRISAT (1984), these agro - meteorological indices are also favorable for millet cultivation.

2.2 Management of Experimental Birds

Three hundred (300) unsexed, day-old, broiler chickens of the *Cobb* strain were purchased from Pieridox hatchery in Jos, Plateau State for the experiment. Two weeks prior to the birds' arrival, the experimental pens were cleaned, washed, disinfected and fumigated. Furthermore. feeders, drinkers and all other necessary equipment were also cleaned. A week after, litter material (wood shavings) were spread in the experimental pens to a floor depth of approximately 3 inches. Adequate heating/lighting facilities were also provided. Brooding, this lasted for a period of 14 days, commenced with the arrival of chicks. Two (2) electric bulbs of 200 watts capacity each were used to provide the necessary warmth needed in the brooding room. The birds were fed chick mash during this period. They were also given the first dose of IBDV (Gumboro vaccine) at 7 days, followed by an anti-stress drug for two consecutive days. Another vaccine, New Castle Disease Vaccine NCDV (LASOTA) was also administered on the 13th day. At the end of this brooding period, the birds were randomly assigned to five dietary treatments in a completely randomized design (CRD). Each treatment was replicated thrice containing 20 birds each giving a total of

sixty birds (60) per treatment. Experimental diets and clean drinking water were served *ad libitum* throughout the six-week trial period. Birds were also given the second dose of Infectious Bursal Disease vaccine (Gumboro vaccine) (Booster) on the 21st day and another one for NCDV a week after. All vaccines and drugs were administered orally. The experiment was conducted in a completely randomized design (CRD).

Table 1: Ingredients Composition (%) and Calculated Analysis of Dietary Levels of Super Sosat Millet as Replacement for Maize in Sunflower Meal- Based Diets Fed to Starter Broiler Chickens (1-3 weeks)

	DIETS				
Ingredients	**1**	**2**	**3**	**4**	**5**
Maize	47.75	35.81	23.88	11.94	0.00
Super SOSAT millet	0.00	11.94	23.88	35.81	47.75
Sunflower meal	32.45	32.45	32.45	32.45	32.45
Palm oil	3.00	3.00	3.00	3.00	3.00
Wheat Offal	7.00	7.00	7.00	7.00	7.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.15	0.15	0.15	0.15	0.15
Lysine	0.15	0.15	0.15	0.15	0.15
TOTAL	**100**	**100**	**100**	**100**	**100**
Calculated Analysis (%)					
ME (Kcal/kg)	2897.00	2873.00	2865.00	2849.00	2831.00
Crude Protein	23.00	23.00	23.00	23.00	23.00
Crude Fibre	3.52	3.58	3.62	3.67	3.70
Ether Extract	3.65	3.59	3.53	3.47	3.41
Calcium	1.53	1.53	1.53	1.53	1.53
Phosphorus	1.02	1.02	1.02	1.03	1.03
Methionine	0.53	0.55	0.58	0.58	0.58
Lysine	0.87	0.87	0.87	0.86	0.86

ME; Metabolizable energy

*Vit/mineral premix supplied/Kg of Diet: Vit. A, 12,500 IU; Vit. D_3, 2,500 IU; Vit. E, 30 IU; Vit. K, 2.5 mg; Riboflavin, 6 mg; Pantothenic acid, 10 mg; Vit. B, 2 mg; Niacin, 30 mg; Vit. B_{12}, , 2.2 mg; Biotin, 0.05 mg; Folic acid, 1 mg; Chlorine chloride, 0.3 mg; Antioxidant, 0.125 mg; Iron, 100 mg; Manganese, 100 mg; Zinc, 100 mg; Iodine, 1.5 mg; Cobalt, 0.5 mg; Selenium, 0.1 mg and Copper 10 mg.

2.3 Experimental Diets

Five experimental diets for both starter (23 % CP) and finisher (20 %) phases were formulated. Super Sosat Millet (SSM) replaced maize at 0, 25, 50, 75 and 100 % levels, designated as diets 1 (control), 2, 3, 4, and 5 respectively. Groundnut cake was the main plant protein source used in the diets. Broiler starter and finisher diets were fed for 3 weeks each. Ingredients and percentage composition of dietary SSM as replacement for maize are presented in Tables 1 and 2.

Table 2: Ingredients Composition (%) and Calculated Analysis of Dietary Levels of Super Sosat Millet as Replacement for Maizein Sunflower Meal- Based Diets Fed to Finisher Broiler Chickens (4-6weeks)

	DIETS				
Ingredients	**1**	**2**	**3**	**4**	**5**
Maize	52.41	39.31	26.21	13.10	0.00
Super SOSAT millet	0.00	13.10	26.21	39.31	52.41
Sunflower meal	19.69	19.69	19.69	19.69	19.69
Palm oil	3.00	3.00	3.00	3.00	3.00
Wheat Offal	15.00	15.00	15.00	15.00	15.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20
TOTAL	**100**	**100**	**100**	**100**	**100**
Calculated Analysis (%)					
ME (Kcal/kg)	2995.00	2982.00	2970.00	2962.00	2950.00
Crude Protein	20.00	20.00	20.00	20.00	20.00
Crude Fibre	3.62	3.67	3.72	3.77	3.81
Ether Extract	3.87	3.80	3.74	3.67	3.60
Calcium	1.52	1.53	1.53	1.54	1.54
Phosphorus	1.00	1.01	1.01	1.02	1.02
Methionine	0.55	0.55	0.57	0.57	0.57
Lysine	0.87	0.87	0.86	0.86	0.85

ME; Metabolizable Energy

*Vit/mineral premix supplied/Kg of Diet: Vit. A, 8,500IU; Vit. D_3, 2,000IU; Vit. E, 10mg; Vit. K_3, 1.5 mg; Vit. B_1, 1.6 mg; Vit. B_2, 4 mg; Niacin, 20 mg; Pantothenic acid, 5 mg; Vit. B_6, 1.5 mg; Vit. B_{12}, 0.01 mg; Folic acid, 0.5 mg; Biotin, 0.75 mg; Chlorine chloride, 175 mg; Cobalt, 0.2 mg; Copper, 3 mg; Iodine, 1 mg; Iron, 20 mg; Manganese, 40 mg; Selenium, 0.2 mg; Zinc, 30 mg and Antioxidant, 1.25 mg.

2.4 Data Collection

At the end of the experiment, 30 birds were randomly selected, two per replicate, fasted for 12 hours and slaughtered for carcass analysis. The weight of each bird was taken before slaughter. Hot weight of carcasses and internal organs were immediately measured using an electronic balance. Dressing percentage was obtained using the relationship. Blood samples from 30 randomly selected birds, two per replicate, were also collected to analyze some haematological and biochemical parameters of the chickens. To avoid temporary elevation of blood metabolites through feeding, the birds were fasted overnight (Bush, 1991). However, potable drinking water was provided as usual. The following morning, blood was collected using sterile syringe and needle sets (5 ml, 21G) Accordingly 5 ml of blood from the left-wing vein of each bird was drawn. Venous blood, mostly found on the left side of the body, is usually the specimen of choice for routine laboratory test (Baker *et al*., 1998). Samples for haematological study were collected in properly labeled sterilized non-vacuum tubes containing a potassium salt of ethylene diamine tetra-acetic acid (K_3EDTA) as an anti-coagulant. However, samples for serological analysis were collected in EDTA-free tubes. In the laboratory, serum was obtained by allowing the samples to stand at room temperature for a period of 2 hours and then centrifuged at 2000 round per minute (rpm) for 10 minutes to separate the plasma from the serum. The blood samples were analyzed for haematological parameters according to routine clinical methods (Baker *et al*., 1998). PCV was determined using the micro-haematocrit (capillary tube) method as described by Gamal (2012). Haemoglobin concentration was determined using the Sahli's method as described by Balasubramaniam and Malathi (1992). The RBC count was determined using the Haemocytometer (Neubauer) method as described by Campbell (1986) and Mary (2012). Erythrocyte indices were calculated from RBC, PCV and Hb values using the following relationships as described by Jain, (1993). MCV, MCH and MCHC values were calculated. The serum metabolites (total protein, albumin, globulin, total cholesterol, triglycerides, creatinine, uric acid,), enzymes (alanine aminotransferase (ALT), aspartate aminotransferase (AST)), electrolytes (calcium, sodium, potassium) were analyzed using the UV/Visible Spectrophotometer as described by Nicole *et al*. (2009).

2.5 Data analysis

All data were analyzed by one-way analysis of variance (ANOVA) using the statistcal package, SPSS version 23. Differences between treatment means were separated using Duncan's Post Hoc method (Duncan, 1955).

3.0 Results and Discussion

Carcass and organ characteristics of broiler chickens fed Super SOSAT millet as replacement for maize are presented in Table 3. All carcass indices measured were significantly ($P<0.05$) affected by the dietary treatments. However, only few organs showed influence of super SOSAT millet. Live weight of birds fed super SOSAT millet based diets (1.53 – 1.65 kg) were higher and similar among millet fed groups compared to the control (1.24 kg). The same trend was followed in plucked and eviscerated weights. However, carcass weight was highest ($P<0.05$) for birds on diet 5 (1.08kg) though did not differ from those on diets 2 (0.92 kg) and 3 (0.94 kg), followed by diet 4 (0.89 kg) and 1 (0.72 kg). This agrees with the report of Kawu *et al.* (2020) using whole grain *gayamba* millet but contradicts the report of Medugu *et al.* (2010) who reported that the replacement of maize with pearl millet did not have significant ($P>0.05$) effect. In the same way, broiler chickens fed diet 5 (66.00 %) had higher dressing percent ($P<0.05$) than those on other diets which were the same (56.83 – 59.42 %). Values for dressing percentage were slightly lower than 70.77 % reported by Ravindran and Savakanesan (1996) as the ideal dressing percentage for well-finished broiler chickens. Organs weight as percentage of live weight showed significant influence of diet on heart weight with birds on diet 5 (0.61 %) having higher ($P<0.05$) weight which did not differ from that of birds on diets 1 (0.46 %) and 3 (0.52 %). Each of diets 2 and 4 had a lower value of 0.38 % which was comparable to diets 1 and 3. Gizzard weight was highest ($P<0.05$) for birds on the control diet (3.41 %), but was comparable to those on diet 5 (3.25 %), but lower for those on other diets (2.86 – 2.88

%) which were the same and similar to diet 5. The weight of pancreas was also significantly (P<0.05) higher for those on diet 1 (0.28 %) though similar to diet 3 (0.22 %), 5 (0.22 %) and 2 (0.23 %) and lower on diet 4 (0.17 %). However, diet 4 did not differ from diets 2, 3 and 5. Legs weight (4.23 – 4.69 %) did not significantly (p>0.05) differ among diets. Lung weight (0.46 – 0.58 %), head weight (2.59 – 2.81 %), kidney weight (0.17 – 0.29 %), small intestine weight (1.40 - 1.70 %) and that of large intestine (3.70 – 4.16 %), were also not significantly (P>0.05) affected. The relative weight of caeca (1.11 – 1.35 %) and liver (1.85 – 2.07 %) were also not influenced by the replacement of maize with super SOSAT millet. The weights of some internal organs like liver, kidney and hepatic enzymes are indicators of toxicity (Bone, 1979).

Table 3: Carcass and Organ Characteristics of Broiler Chickens Fed Super SOSAT millet as eplacement for Maize in Sunflower Meal Based Diets

Parameters	**DIETS**					
	1	**2**	**3**	**4**	**5**	**SEM**
Live weight (kg)	1.24^{b}	1.62^{a}	1.57^{a}	1.53^{a}	1.65a	**0.09***
Plucked weight (g)	1.11^{b}	1.39^{a}	1.42^{a}	1.37^{a}	1.47a	0.07*
Eviscerated weight (g)	0.80^{b}	1.03^{a}	1.04^{a}	1.00^{a}	1.16a	0.06*
Carcass Weight (g)	0.72^{c}	0.92^{ab}	0.94^{ab}	0.89^{b}	1.08^{a}	0.05*
Dressing (%)	57.80^{b}	56.83^{b}	59.42^{b}	57.92^{b}	66.00a	2.11*
Organ weights expressed as percentage of live weight						
Leg weight	4.47	4.23	4.69	4.47	4.64	0.26^{NS}
Lung weight	0.47	0.58	0.57	0.55	0.46	0.07^{NS}
Head weight	2.78	2.59	2.81	2.73	2.72	0.14^{NS}
Kidney weight	0.29	0.24	0.20	0.17	0.18	0.06^{NS}
Heart weight	0.46^{ab}	0.38^{b}	0.52^{ab}	0.38^{b}	0.61^{a}	0.06*
Gizzard weight	3.41^{a}	2.88^{b}	2.86^{b}	2.86^{b}	3.25^{ab}	0.16*
Small intestine Weight	1.40	1.50	1.43	1.70	1.42	0.13^{NS}
Large intestine weight	4.09	3.80	4.14	3.70	4.16	0.58^{NS}
Caeca weight	1.35	1.18	1.11	1.41	1.19	0.14^{NS}
Abdominal fat weight	2.01	2.02	2.06	1.86	1.92	0.35^{NS}
Liver weight	1.95	1.85	1.99	2.07	1.99	0.14^{NS}
Pancreas weight	0.28^{a}	0.23^{ab}	0.22^{ab}	0.17^{b}	0.22^{ab}	0.03*

^{abc}Means bearing different superscripts within the same row differ; * = (P<0.05); ns= Not significant; SEM = Standard Error of Means

Kidney (0.17 – 0.29 %) and liver weights (1.85 – 2.07 %)) obtained in the present study were not significantly affected by the dietary treatments. This is an indication that the test material (super SOSAT millet) was as safe as maize. This also confirms an earlier finding by Ibe *et al.* (2014) who reported no significant (P>0.05) difference in liver weight (2.16 vs 1.97 %) and intestinal weight (3.66 vs 4.00 %) in yellow sorghum and pearl millet based diets.. The relative weight of abdominal fat (1.86 – 2.02%) was not significantly (P<0.05) influenced by dietary replacement of super SOSAT millet for maize. This could be attributed to the relatively lower energy level in millet (Hassan *et al.,* 2021). This finding however, contradicts earlier reports by Rama Rao *et al.* (2002) and Torres *et al.* (2013) who observed that relative abdominal fat weight was significantly (P<0.05) higher in birds fed millet-based diets and Medugu *et al.* (2010) who reported significantly (P<0.05) lower weights in birds fed millet-based diets than those fed maize based diets.

3.1 Blood Profiling

Results for blood analysis of broiler chickens fed diets containing super SOSAT millet is presented in Table 4. Except for red blood cells (RBC), Mean corpuscular volume (MCV) and hydrocarbonate, no blood parameter was significantly (P>0.05) affected by the diets. The RBC count of birds on diets 5 (1.40 x 10^6/µl) and 4 (1.43 x 10^6/µl) which did not differ from those on diets 3 (1.23x 10^6/µl) and 1 (1.30 x 10^6/µl), were significantly (P<0.05) higher than that of birds fed diet 2 (1.00 x 10^6/µl) which was also comparable to diets 1 and 2. The significantly (P<0.05) higher red blood cells count of birds fed super SOSAT millet based diets signifies an improved oxygen carrying capacity and better metabolic function (Iyayi and Tewe, 1998). The values obtained are however lower than 3.76 – 4.11 x 10^6 / µl reported by (Hatim *et al.,* 2019) and 2.36 – 2.37x 10^6 / µl Kawu *et al.* (2020). They are also lower than the normal values of 2.20 – 3.30 and 2.36 – 2.37x 10^6 / µl (Branson *et al.,* 1994). According to Jain (1993), lower than normal RBC values could be an indication of anemia. However, Chineke (2006) asserted that haematlogical parameters can also be influenced by environmental factors. This could perhaps be the cause of lower than normal RBC count obtained in this study. MCV was higher (P<0.05) on diet 2 (289.00 fl) than for other diets (200.66 – 210.00 fl) which were similar. This shows that the red blood cells have larger sizes and might contain higher concentration of haemoglobin. However, all the MCV values were higher than 81.60 – 89.10 fl (Jain, 1993) and 120 – 137 fl (Branson *et al.,* 1994) reported for normal and healthy chickens. All other parameters were within the normal reference range indicating that the birds were neither anaemic nor undernourished. The serum of birds fed diet 4 (30.67 mmol/l) had higher (P<0.05) concentration of hydrocarbonate though similar to those on diet 1 (27.66 mmol / l) followed by birds on diets 3 (25.00mmol/l) and 5 (25.66 mmol / l), while diet 2 (21.33 mmol / l) had the lowest. Conversely, packed cell volume (24.33 – 29.00 %), white blood cells (3.67 – 4.80x 10^3/µl), haemoglobin (5.77 – 7.33 g/dl), mean corpuscular haemoglobin (45.33 – 52.33 pg), and mean corpuscular haemoglobin concentration (20.00 – 24.33 %) did not differ among the diets. Similarly, the serum metabolites potassium (4.26 – 6.53 mmol / l), chloride (86.00 – 97.66 mmol / l), creatinine (80.33 – 96.00 mmol / l) and cholesterol (4.50 – 6.50 mmol / l) were not significantly different across the diets. In addition, there was no significant effect of super SOSAT millet on serum glucose (6.20 – 7.63 mmol / l), total protein (5.90 – 7.63 g / dl), albumin (3.60 – 4.27 g / dl) and aspartate transaminase (6.00 – 9.33 iu / l).

Table 4: Haematological and Biochemical parameters of Broiler Chickens fed Super SOSAT Millet as Replacement for Maize in Sunflower Meal Based Diets

Parameters	DIETS					SEM
	1	2	3	4	5	
Packed Cell Volume (%)	26.33	28.66	24.33	28.33	29.00	1.51^{NS}
WBC ($x10^3/\mu l$)	4.50	3.67	4.36	3.97	4.80	0.65^{NS}
RBC ($x10^6/\mu l$)	1.30^{ab}	1.00^{b}	1.23^{ab}	1.43^{a}	1.40^{a}	0.09*
Haemoglobin (g/dl)	5.97	5.90	5.77	6.50	7.33	0.56^{NS}
MCV (fl)	204.33^{b}	289.00^{a}	208.00^{b}	200.66^{b}	210.00^{b}	16.42*
MCH (pg)	45.33	59.33	46.00	46.00	52.33	4.79^{NS}
MCHC (%)	22.33	20.00	23.33	22.67	24.33	1.79^{NS}
Potassium (mmol/l)	5.20	4.26	4.93	6.53	6.33	0.98^{NS}
Chloride (mmol/l)	97.66	93.33	96.33	90.00	86.00	3.97^{NS}
Hydrocarbonate (mmol/l)	27.66^{ab}	21.33^{c}	25.00^{bc}	30.67^{a}	25.66^{bc}	1.51*
Creatinine (mmol/l)	96.00	82.66	83.67	80.33	86.33	5.76^{NS}
Cholesterol (mmol/l)	4.50	4.93	5.03	4.63	6.50	0.67^{NS}
Glucose (mmol/l)	6.66	7.40	9.20	6.20	7.10	1.16^{NS}
Total Protein (g/dl)	6.93	7.63	6.67	6.50	5.90	0.79^{NS}
Albumin (g/dl)	3.60	4.27	3.87	3.63	4.00	0.47^{NS}
Aspartate transaminase (iu/l)	7.00	6.00	9.33	9.33	8.00	1.45^{NS}

WBC= White Blood Cells, RBC= Red Blood Cells, MCV= Mean Corpuscular Volume, MCH= Mean Corpuscular Haemoglobin, MCHC= Mean Corpuscular Haemoglobin Concentration

^{abc}Means bearing different superscripts within the same row differ; * = ($P<0.05$); ns= Not significant; SEM = Standard Error of Means

4.0 Conclusion and Recommendations

From the results of the current experiment, it is concluded that super SOSAT millet can completely replace up to 100% of dietary maize in sunflower meal based broiler chickens diets without significant metabolic disruptions. Most haematological and biochemical parameters were stable, suggesting overall safety for blood health and metabolism. Similarly, based on the higher dressing percent of 66.00% for broiler chickens in diet 5 compared to the others, this diet is recommended for broiler chickens.

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